

**FAIRCHILD**  
SEMICONDUCTOR®

**QFET®**

## FQP45N15V2/FQPF45N15V2 150V N-Channel MOSFET

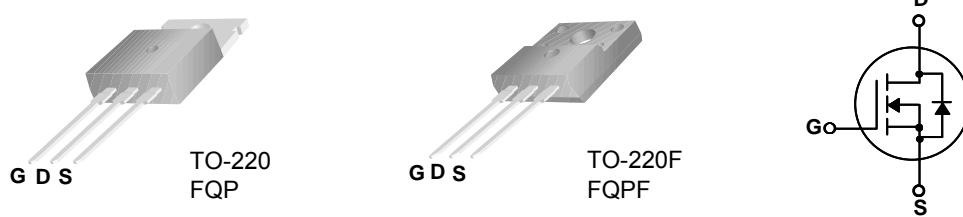
### General Description

These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology.

This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for DC to DC converters, synchronous rectification, and other applications lowest  $R_{DS(on)}$  is required.

### Features

- 45A, 150V,  $R_{DS(on)} = 0.04\Omega$  @  $V_{GS} = 10$  V
- Low gate charge ( typical 72 nC)
- Low  $C_{RSS}$  ( typical 135 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability



### Absolute Maximum Ratings

$T_C = 25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	FQP45N15V2	FQPF45N15V2	Units
$V_{DSS}$	Drain-Source Voltage	150		V
$I_D$	Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ )	45	45 *	A
	- Continuous ( $T_C = 100^\circ\text{C}$ )	31	31 *	A
$I_{DM}$	Drain Current - Pulsed	(Note 1)	180	A
$V_{GSS}$	Gate-Source Voltage		$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy	(Note 2)	1124	mJ
$I_{AR}$	Avalanche Current	(Note 1)	45	A
$E_{AR}$	Repetitive Avalanche Energy	(Note 1)	22	mJ
$dv/dt$	Peak Diode Recovery $dv/dt$	(Note 3)	4.5	V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ )	220	66	W
	- Derate above $25^\circ\text{C}$	1.47	0.44	W/ $^\circ\text{C}$
$T_J, T_{STG}$	Operating and Storage Temperature Range		-55 to +150	$^\circ\text{C}$
$T_L$	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds		300	$^\circ\text{C}$

\* Drain current limited by maximum junction temperature

### Thermal Characteristics

Symbol	Parameter	FQP45N15V2	FQPF45N15V2	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.68	2.25	$^\circ\text{C}/\text{W}$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink Typ.	0.5	--	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	62.5	$^\circ\text{C}/\text{W}$

Electrical Characteristics		$T_C = 25^\circ\text{C}$ unless otherwise noted				
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>Off Characteristics</b>						
$\text{BV}_{\text{DSS}}$	Drain-Source Breakdown Voltage	$V_{\text{GS}} = 0 \text{ V}$ , $I_D = 250 \mu\text{A}$	150	--	--	V
$\Delta \text{BV}_{\text{DSS}} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , Referenced to $25^\circ\text{C}$	--	0.21	--	$\text{V}/^\circ\text{C}$
$I_{\text{DSS}}$	Zero Gate Voltage Drain Current	$V_{\text{DS}} = 150 \text{ V}$ , $V_{\text{GS}} = 0 \text{ V}$	--	--	1	$\mu\text{A}$
		$V_{\text{DS}} = 120 \text{ V}$ , $T_C = 150^\circ\text{C}$	--	--	10	$\mu\text{A}$
$I_{\text{GSSF}}$	Gate-Body Leakage Current, Forward	$V_{\text{GS}} = 30 \text{ V}$ , $V_{\text{DS}} = 0 \text{ V}$	--	--	100	nA
$I_{\text{GSSR}}$	Gate-Body Leakage Current, Reverse	$V_{\text{GS}} = -30 \text{ V}$ , $V_{\text{DS}} = 0 \text{ V}$	--	--	-100	nA
<b>On Characteristics</b>						
$V_{\text{GS(th)}}$	Gate Threshold Voltage	$V_{\text{DS}} = V_{\text{GS}}$ , $I_D = 250 \mu\text{A}$	2.0	--	4.0	V
$R_{\text{DS(on)}}$	Static Drain-Source On-Resistance	$V_{\text{GS}} = 10 \text{ V}$ , $I_D = 22.5 \text{ A}$	--	0.034	0.04	$\Omega$
$g_{\text{FS}}$	Forward Transconductance	$V_{\text{DS}} = 40 \text{ V}$ , $I_D = 22.5 \text{ A}$ (Note 4)	--	40	--	S
<b>Dynamic Characteristics</b>						
$C_{\text{iss}}$	Input Capacitance	$V_{\text{DS}} = 25 \text{ V}$ , $V_{\text{GS}} = 0 \text{ V}$ , $f = 1.0 \text{ MHz}$	--	2330	3030	pF
$C_{\text{oss}}$	Output Capacitance		--	510	670	pF
$C_{\text{rss}}$	Reverse Transfer Capacitance		--	135	176	pF
<b>Switching Characteristics</b>						
$t_{\text{d(on)}}$	Turn-On Delay Time	$V_{\text{DD}} = 75 \text{ V}$ , $I_D = 45 \text{ A}$ , $R_G = 25 \Omega$	--	22	54	ns
$t_r$	Turn-On Rise Time		--	232	474	ns
$t_{\text{d(off)}}$	Turn-Off Delay Time		--	224	458	ns
$t_f$	Turn-Off Fall Time		--	246	502	ns
$Q_g$	Total Gate Charge	$V_{\text{DS}} = 120 \text{ V}$ , $I_D = 45 \text{ A}$ , $V_{\text{GS}} = 10 \text{ V}$	--	72	94	nC
$Q_{\text{gs}}$	Gate-Source Charge		--	13	--	nC
$Q_{\text{gd}}$	Gate-Drain Charge		--	31	--	nC
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
$I_S$	Maximum Continuous Drain-Source Diode Forward Current	--	--	45	--	A
$I_{\text{SM}}$	Maximum Pulsed Drain-Source Diode Forward Current	--	--	180	--	A
$V_{\text{SD}}$	Drain-Source Diode Forward Voltage	$V_{\text{GS}} = 0 \text{ V}$ , $I_S = 45 \text{ A}$	--	--	1.4	V
$t_{\text{rr}}$	Reverse Recovery Time	$V_{\text{GS}} = 0 \text{ V}$ , $I_S = 45 \text{ A}$ , $dI_F / dt = 100 \text{ A}/\mu\text{s}$	--	176	--	ns
$Q_{\text{rr}}$	Reverse Recovery Charge		--	1.19	--	$\mu\text{C}$

**Notes:**

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $L = 0.74\text{mH}$ ,  $I_{\text{AS}} = 45\text{A}$ ,  $V_{\text{DD}} = 50\text{V}$ ,  $R_G = 25 \Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{\text{SD}} \leq 45\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{\text{DD}} \leq \text{BV}_{\text{DSS}}$ , Starting  $T_J = 25^\circ\text{C}$
4. Pulse Test : Pulse width  $\leq 300\mu\text{s}$ , Duty cycle  $\leq 2\%$
5. Essentially independent of operating temperature

## Typical Characteristics

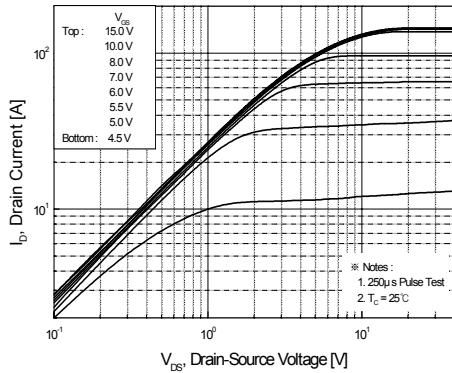


Figure 1. On-Region Characteristics

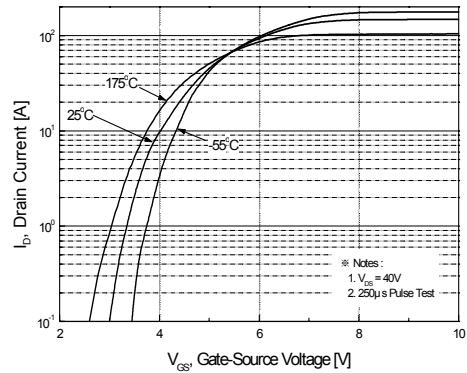


Figure 2. Transfer Characteristics

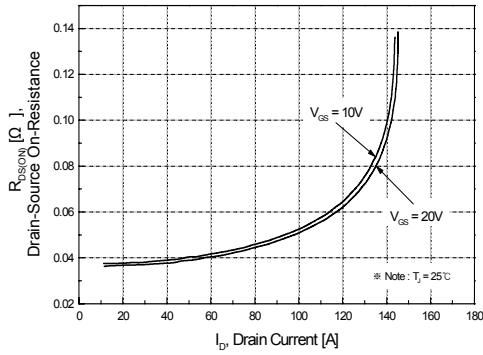


Figure 3. On-Resistance Variation vs  
Drain Current and Gate Voltage

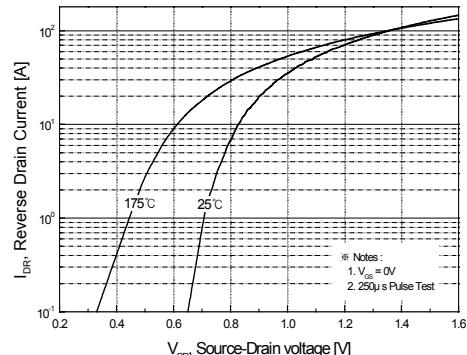


Figure 4. Body Diode Forward Voltage  
Variation with Source Current  
and Temperature

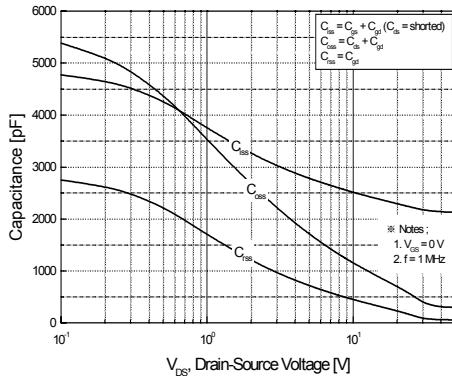


Figure 5. Capacitance Characteristics

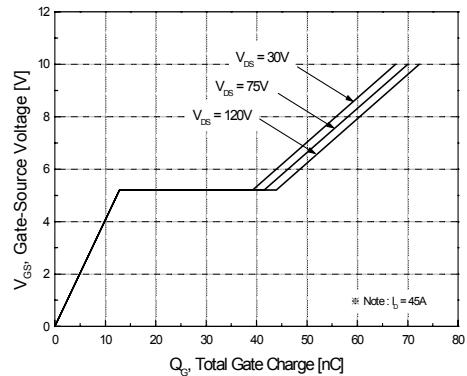
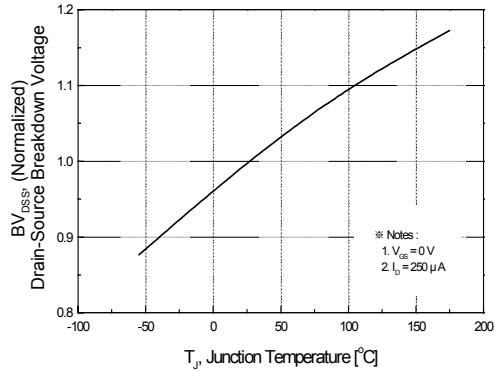
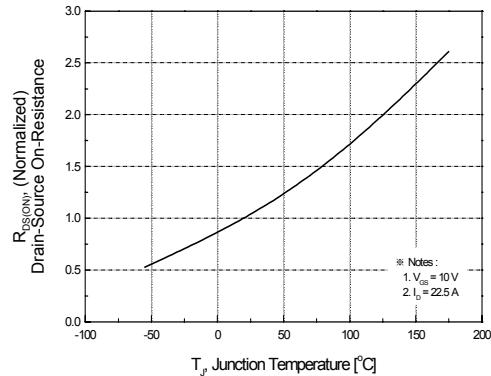


Figure 6. Gate Charge Characteristics

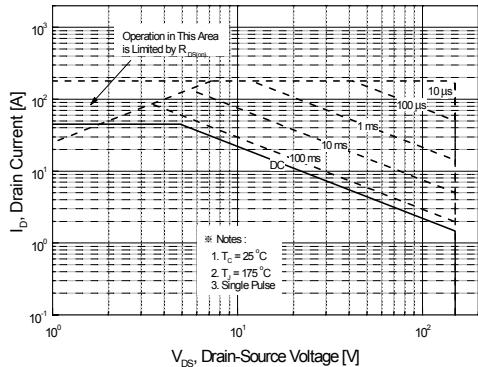
## Typical Characteristics (Continued)



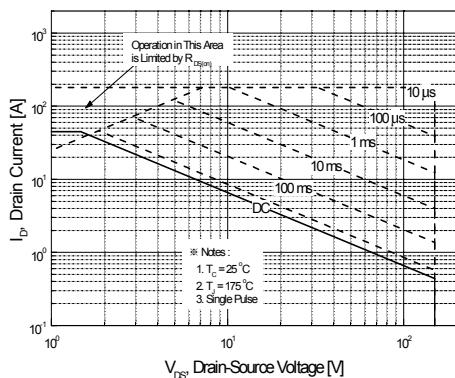
**Figure 7. Breakdown Voltage Variation vs Temperature**



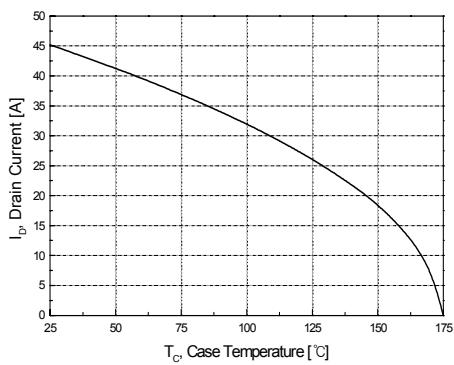
**Figure 8. On-Resistance Variation vs Temperature**



**Figure 9-1. Maximum Safe Operating Area for FQP45N15V2**

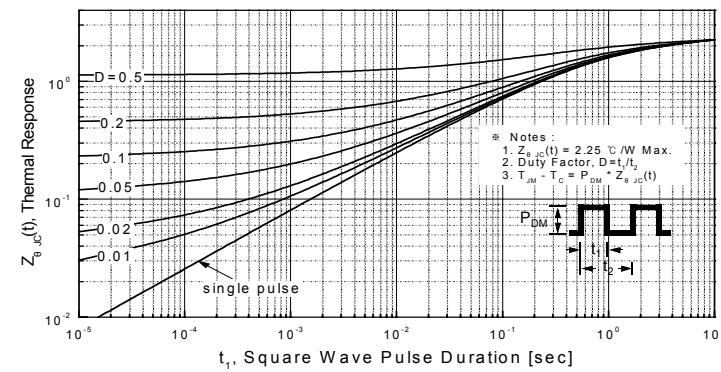
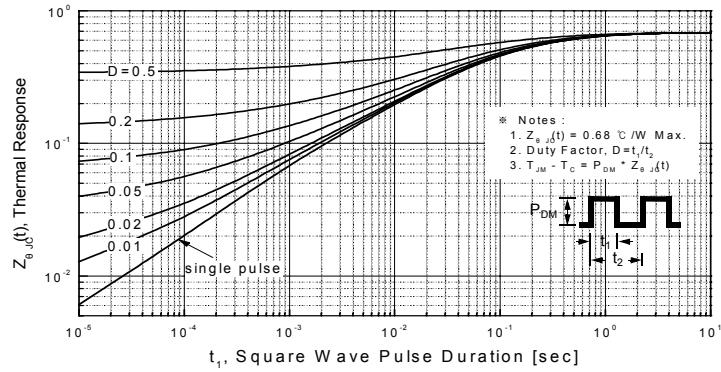


**Figure 9-2. Maximum Safe Operating Area for FQPF45N15V2**

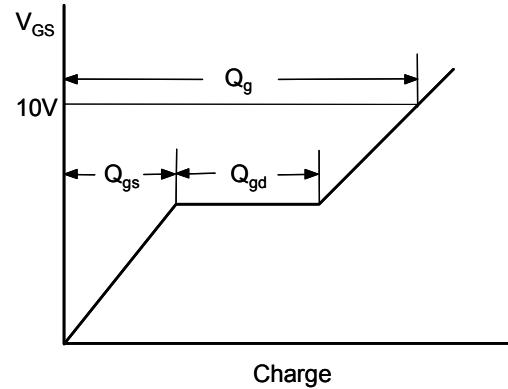
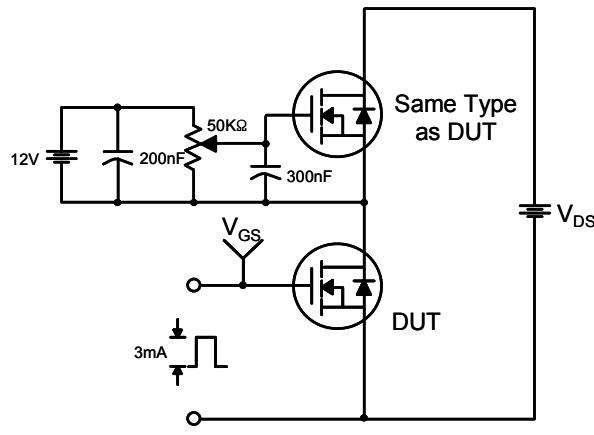


**Figure 10. Maximum Drain Current vs Case Temperature**

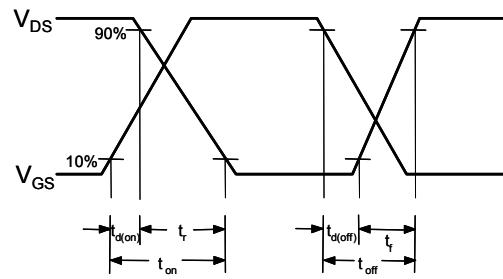
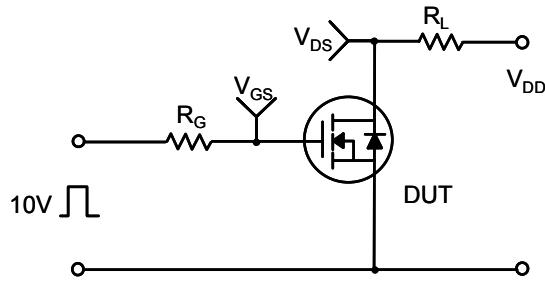
## Typical Characteristics (Continued)



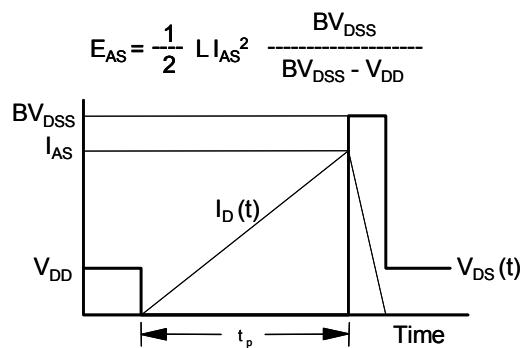
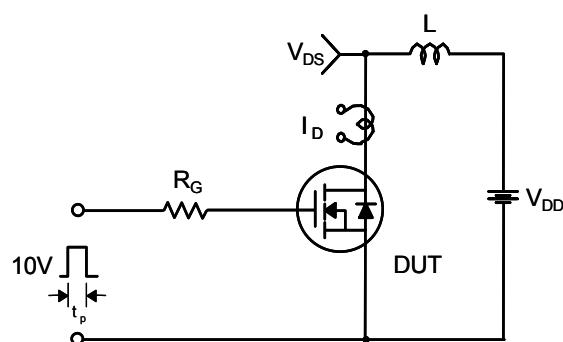
Gate Charge Test Circuit & Waveform



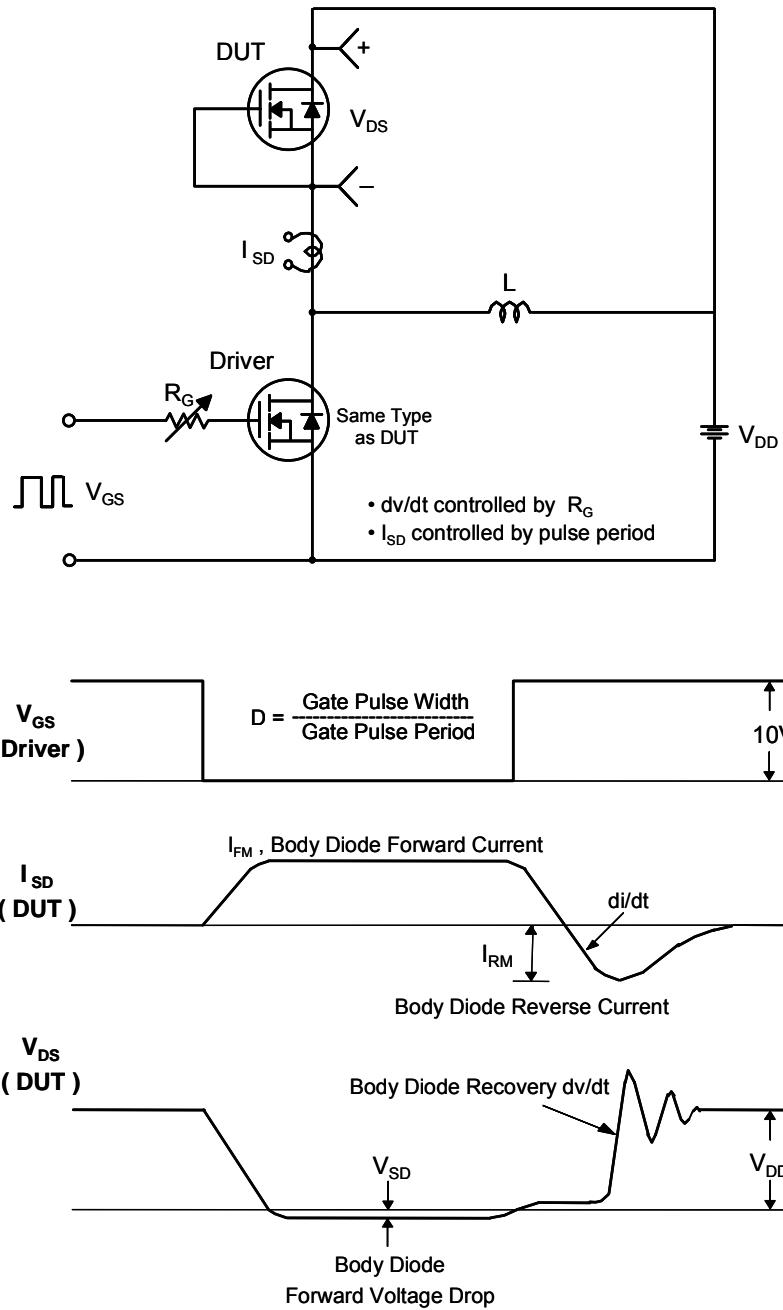
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

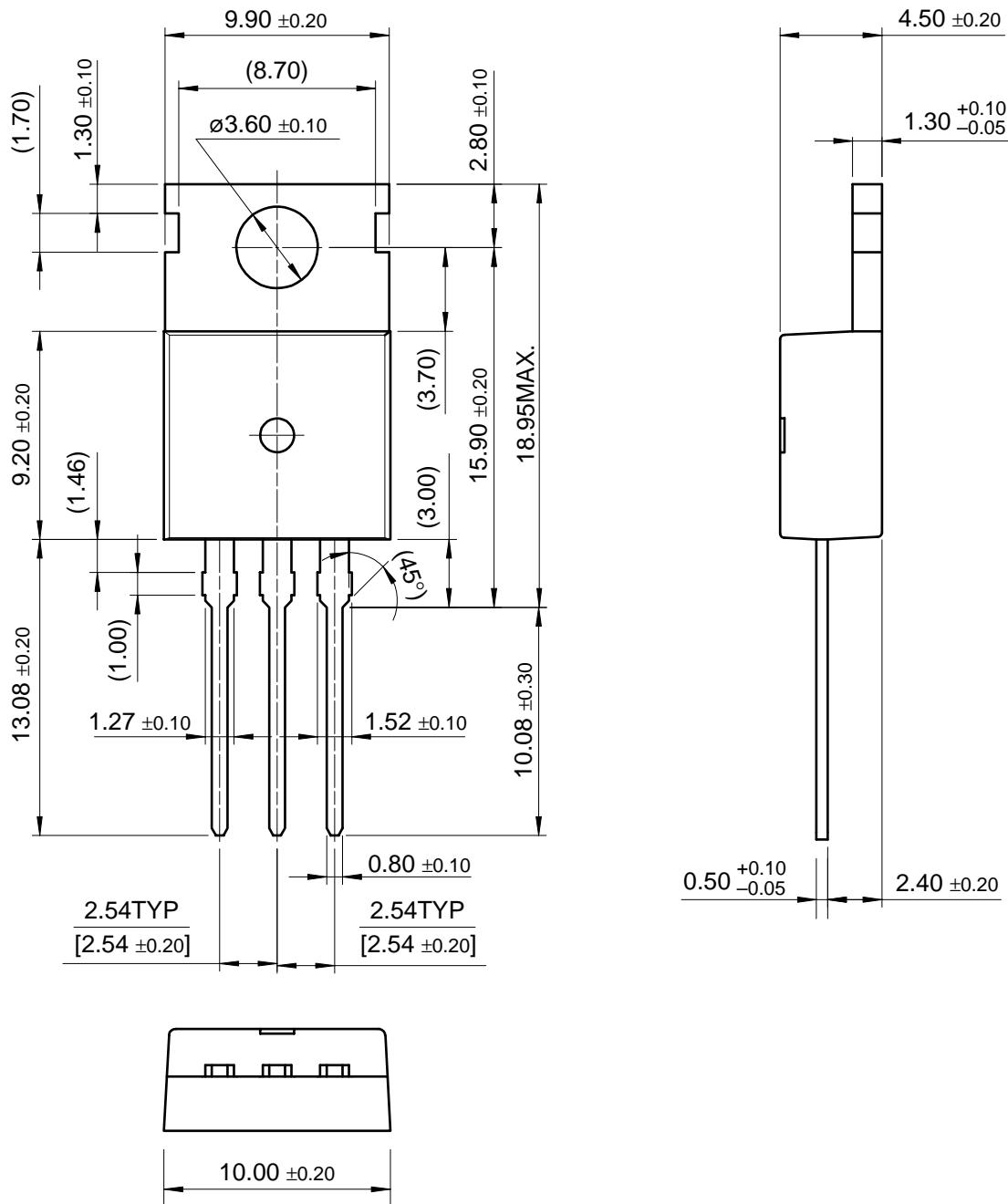


Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms



## Package Dimensions

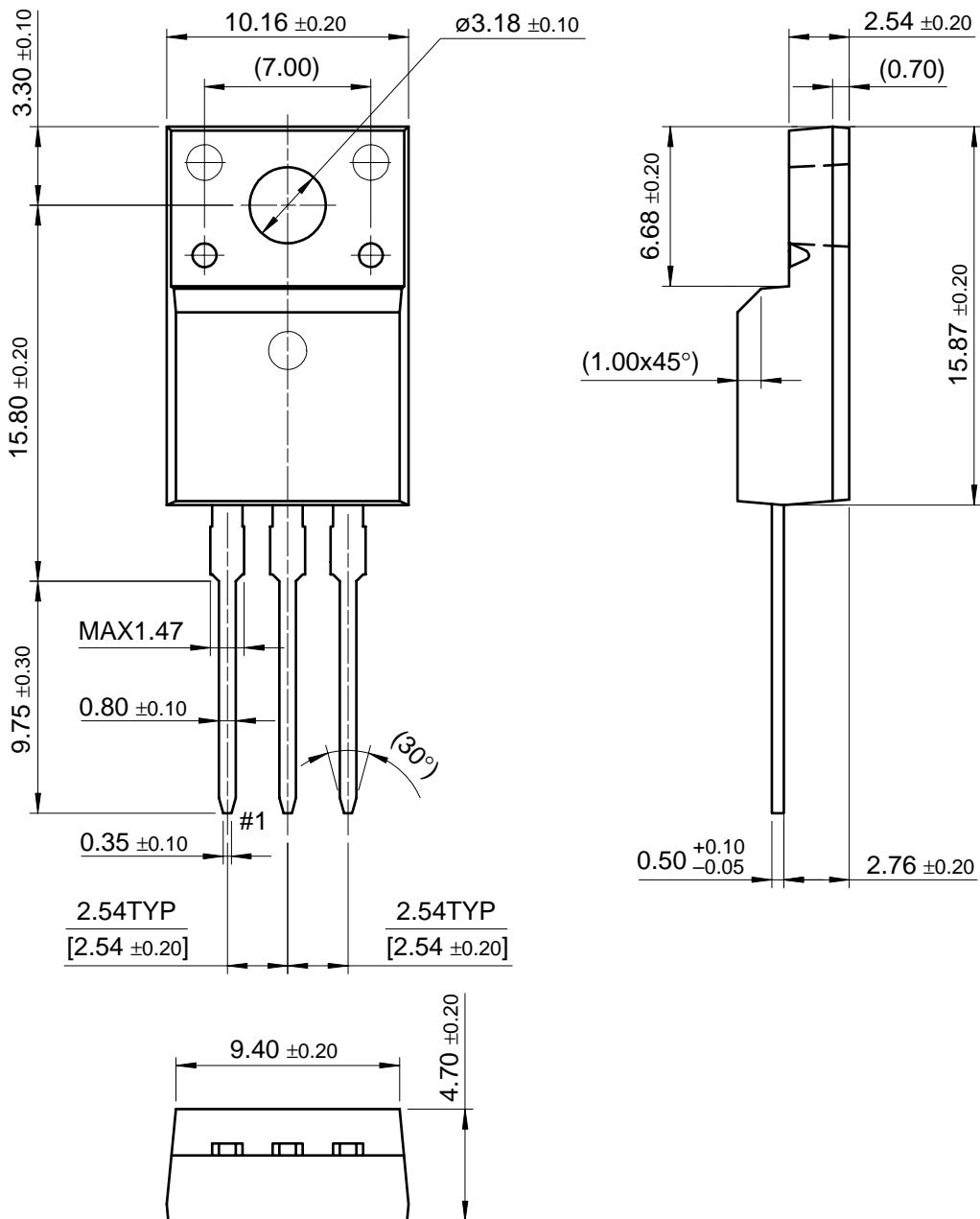
## TO-220



Dimensions in Millimeters

## Package Dimensions (Continued)

## TO-220F



Dimensions in Millimeters

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